LITERAL TRANSLATION

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DEVICE AND METHOD FOR CLEANING A THICK MATTER DELIVERY PIPE

The invention concerns a device for cleaning a thick matter delivery pipe according to the pre-characterizing portion of claim 1, a process for cleaning a thick matter delivery pipe according to the pre-characterizing portion of claim 9, as well as a squeeze valve that can be inserted onto a flexible delivery pipe according to the pre-characterizing portion of claim 15.

Thick matter such as concrete is delivered to a construction site in that it is pumped by means of a thick matter pump from a material supply container through a thick matter delivery pipe extending all the way to the construction site. Following utilization of the pump, the delivery pipe must be emptied of the residual material remaining therein and cleaned. The residual material can be pumped back to the material supply container. This however has the disadvantage, that the returned concrete can no longer be employed and must be disposed of. In the case of long thick matter delivery pipes, there is the additional problem that the material supply container can run over. For this reason in most cases a cleaning body, such as for example a ball sponge, is introduced at the inlet side of the thick matter conveyor pipe. The sponge ball lies with its entire outer circumference against the inner surface of the thick matter delivery pipe and is advanced through the thick matter delivery pipe until the end by application of air or water under pressure. At this time, it pushes the residual material remaining in the thick matter delivery pipe ahead of it and presses it out of the outlet side of the end-hose.

The use of water as pressure medium has the disadvantage, that the residual concrete is diluted by the water and thus cannot be used. Acting upon the sponge ball with compressed air requires, for safety reasons, a capturing device at the outlet, which prevents the sponge ball causing damage after expulsion out of the end-hose. The capturing device is removed when the pump is in operation and is only attached during the cleaning operation. It's assembly and disassembly is inconvenient and laborious in large applications, such as, for example, mobile concrete pumps.

It is thus the task of the invention to improve a device and a process of the above-described type in such a manner that the cleaning of the thick matter delivery pipe requires less time and effort.

This task is inventively solved by a device with the characteristics of claim 1 and a process with the characteristics of claim 9. The inventive solution is based upon the idea, that the cleaning body is captured in the end-hose by the at least partial closing of the end-hose, after the majority of the residual material has already been removed from the thick matter delivery pipe. For this purpose, a sensor detects a change in consistency of the material in a section of the thick matter delivery pipe as the cleaning body reaches this section. This can occur thereby, that the sensor recognizes the arrival of the cleaning body in the section of the delivery pipe. A further, simple method is comprised therein, that the sensor recognizes whether it is primarily thick matter or primarily fluid that is located in this section of the thick matter delivery pipe. The sensor recognizes the passage-through of the cleaning body through this section by detecting that the consistency of the material contained in the section changes: first, thick matter such as concrete is contained in this section, then after passage-through of the cleaning body, fluid is contained.

In principle it is possible to use water as the fluid, wherein a water pump is employed for conveying the water. It is however preferred that air is employed as the fluid and that the device for introduction of the fluid is a compressor for producing compressed air. Thereby it is prevented that the residual concrete remaining in the thick matter delivery pipe is diluted. The residual concrete can then, in large part, be reused and need not be disposed of, which can be expensive.

The sensor is preferably an ultrasound sensor adapted to transmit ultrasound into the thick matter delivery pipe. Ultrasound signals reflected from the inner wall of the thick matter delivery pipe allow the calibrated sensor to determine the consistency of the material located in the pipe-line. Therein the sensor is preferably calibrated for recognition of at least two different material consistencies. These could be, for example, the material pairs "thick matter/fluid", "thick matter/cleaning body" or "fluid/cleaning body". The cleaning body is preferably comprised of a compressible material. It is preferably introduced via a slide valve located at the inlet side of the thick matter delivery pipe.

It is preferred that the end-hose includes a jacket pipe of elastomeric material, preferably of rubber, and that the closable opening includes a squeeze valve for narrowing the internal width or for closure of the end-hose. If the end-hose is closed, then a part of the residual concrete can be retained therein. It is particularly preferable when the inner width of the end-hose is only narrowed, so that the cleaning body remains trapped, however, the largest portion of the residual material can be squeezed out of the end-hose through the narrowed opening, which expelled concrete can then still be used.

The squeeze valve according to claim 15 serves for the rapid closure of the end-hose upon interruption of the pumping process. Thereby, an uncontrolled emission of concrete out of the end-hose is prevented and the environment is protected. This squeeze valve, which is the preferred closure device for the inventive device for cleaning a thick matter delivery pipe, is characterized thereby, that it can be introduced essentially upon any desired flexible pipeline, in particular an end-hose of the thick matter delivery pipe. It is thus not subjected to friction by action of the thick matter conveyed through the pipeline. Further, it has no rigid components which could present a danger of injury, with the exception of the valve.

The hose has on its outer side, opposite to the hollow inner space, a covering of a textile fabric layer. Further, it is advantageous when it is embedded in a sleeve of elastomeric material. The sleeve likewise preferably surrounds the jacket. This imparts an increased shape stability to the squeeze valve. The sleeve preferably has the shape of a hollow cylinder. Therein, the inner diameter must be as large as the outer diameter of the likewise cylindrically shaped pipeline. The jacket is preferably comprised of a preferably multi-layered textile fabric. In the inlet and the outlet opening a valve is preferably provided, so that the hollow space can be easily filled with gas and thereafter be emptied.

In the following the invention will be described in greater detail on a basis of illustrative examples represented schematically in the figure. There is shown in:

Fig. 1 a diagrammatic representation of a device for cleaning a thick matter delivery pipe;

Fig. 2 a perspective representation of an end-hose of the thick matter delivery pipe with the device according to Fig. 1; and

Fig. 3 a sectional representation of a squeeze valve.

The thick matter delivery pipe **10** is designed to convey thick matter, such as concrete, from a material supply container **12** to a construction site **14**. It is mounted on a boom, of which the end section of a boom arm **16** is show in Fig. 2, and carries on its outlet end a rubber end-hose **18**. For cleaning after the pumping process, a cleaning body **22** in the form of a compressible sponge ball, lying with its outer diameter against the inner wall of the thick matter delivery pipe **10**, is introduced into the inlet via a slide valve **20**. At the same time, the slide valve **20** blocks the thick matter conveyor pipe **10** towards the material supply container **12**. By means of a compressor **24**, compressed air is introduced into the thick matter delivery pipe, which pushes the sponge ball **22** through the thick matter delivery pipe **10** in the direction of the end-hose **18**. The residual concrete remaining in the thick matter delivery pipe **10** is thereby removed out the end-hose **18** by the sponge ball **22**. In one section of the thick matter delivery pipe **10,** close to the end-hose **18,** an ultrasound sensor **26** is provided, which the inner wall of the thick matter delivery pipe **10** impinges with ultrasound. The ultrasound reflected from the inner wall and measured by the sensor **26** experiences a change, when the consistency of the material located in the section of the thick matter delivery pipe **10** carrying the sensor changes. This is the case, when the sponge ball **22** passes the sensor **26**. The sponge ball **22** pushes the residual concrete ahead of it as a column; behind the sponge ball **22**, there is primarily compressed air. The change in consistency measured by the sensor **26** from concrete to air is recognized by the sensor, which transmits a signal to the control unit **28.**

The end-hose **18** carries a squeeze value **30**, which upon actuation narrows or closes its inner cross-section. The squeeze valve **30** is actuated by the control unit **28**, when the control unit obtains a signal from the sensor **26** characterizing a change in consistency. The sponge ball **22** remains hanging in the narrowed side of the end-hose **18**, while the residual concrete pushed ahead of the sponge ball **22** can still pass through this location and be reused. Simultaneously, with the actuation of the squeeze valve **30,** the control unit **28** switches off the compressor **24**. For removal of the sponge ball **22** from the end-hose **18**, the squeeze valve **30** is de-tensioned and the thick matter delivery pipe **10** is once again acted upon with compressed air.

The inventive squeeze valve (Fig. 3) exhibits a sleeve **32** of an elastomeric material. The sleeve **32** is cylindrical in shape and has an inner diameter, which is somewhat larger than the outer diameter of the end-hose **18**, so that the squeeze valve **30** can be slid thereupon. In the sleeve **32** a hose **34** of an elastomeric material is embedded, which borders the ring-shaped hollow space **35**. The hose **34** is covered on its outer side with a textile fabric layer **38**. It further exhibits an opening **40**, via which it can be filled with gas, in particular compressed air, via a line **41** (Fig. 2). In the inlet / outlet opening **40** a valve **42** is provided. In the sleeve **32** a ring-shaped jacket **44** is embedded, in the inside of which the hose **34** is situated. The jacket **44** is comprised of multiple layers of a textile fabric and is, for this reason, more difficult to deform than the textile fabric layer **38**. Upon actuation of the squeeze valve, compressed air is introduced via the valve **42** into the hollow space **36**, so that the hose **34** can be narrowed. The jacket **44** constricts the diameter of the hose **34** in the radially inwards from the outside, so that the filling of the hollow space **36** with compressed air brings about a narrowing of the inner diameter of the sleeve **32**. This narrowing is transmitted onto the flexible end-hose **18** passing through the sleeve **32**, so that upon actuation of the squeeze valve **30** it's narrow width can be narrowed or as the case may be the end-hose **18** then can be closed off.

In summary the following can be concluded: The invention relates to a device for cleaning a thick matter delivery pipe **10**, comprising an end-hose **18** which is mounted on an outlet side and is provided with a device **24** for introducing a pressurised fluid into the thick matter delivery pipe **10**, and a cleaning body **22** that can be driven through the delivery pipe **10** by a fluid, an entire circumference of said cleaning body lying against the inner surface of the thick matter delivery pipe **10**. According to the invention, the device comprises a sensor **26** for determining the consistency of the material in a section of the thick matter delivery pipe **10**, a control unit **28** to which a signal can be transmitted from the sensor **26** in the case of a change in the consistency of the material, and a closing device **30** that can be actuated by the control unit when a signal is received and which is used to at least partially close the end-hose **18**.